A

SHORT ACCOUNT

OF THE

SOLAR SYSTEM,

AND OF

COMETS IN GENERAL:

TOGETHER WITH A

PARTICULAR ACCOUNT

OF THE

COMET

THAT WILL APPEAR IN

1789.

BY *BARTHOLOMEW BURGES.*

BOSTON:
PRINTED AND SOLD BY B. EDES & SON,
No. 7, *State-Street.*—1789.

THIS *Work is moſt humbly Dedicated to the Ameri-can Academy of Arts and Sciences in the State of* Maſſachuſetts, *and to the Philoſophical Society of* Pennſylvania.

By their moſt obedient,

humble Servant,

Bartholomew Burges.

RPJ

A SHORT ACCOUNT, &c.

THE Sun, though in reality not exactly placed in the center of the Solar Syſtem, it being in one of the focuſſes of the orbits of the planets, its diſtance from the common center is ſo ſmall in proportion to the diameters of planets orbits, that as it makes no ſenſible difference in the degrees of heat, light, or attraction in the approaches of the planets towards it—as too nice a diſtinction to introduce in general accounts of the Solar Syſtem, it is ſaid to be in the centre of the univerſe.

The Sun is a ſtupendous body of fire, 890,000 miles in diameter. By the various attractions of the circumvolving planets, he is agitated by a ſmall motion round the centre of gravity of the Syſtem, and in 25 days and 6 hours, makes a rotation round his own axis, as is evident from the ſpots on his diſk's diſappearing, and returning to the ſame point on his diſk again, periodically, in the above-mentioned time.

In different periods, and at different diſtances, revolve about the Sun, the planets.

1ſt. Mercury, the neareſt to the Sun, goes round him in 87 days and 23 hours, which makes one of his years. In his courſe round the Sun, he moves at the rate of 109,699 miles

an

an hour : his diameter is 3,000 miles ; but having no viſible ſpots on his diſk, his diurnal rotation is unknown.

2d. Venus, the next planet in order from the Sun, is 9,330 miles in diameter. She moves round the Sun in 224 days and 17 hours, and is 24 days and 8 hours turning round her axis. From whence it appears, that there is only 9 days $\frac{1}{4}$ in one of her Solar years, making her day and night 24 days and $\frac{1}{3}$ of ours long. —— Her diſtance from the Sun is 68,891,468 miles.

3d. The Earth is the next plauet above Venus in the Syſtem. She is 7,970 miles iu diameter—is 95,173,046 miles from the Sun. She turns round her axis in 24 hours, and is 365 days, 6 hours, and 49 minutes going from any equinox or ſolſtiee, and 365 days, 6 hours, and 9 minutes going from any fixed ſtar, and returning to it again—the former being the length of a trophical year, and the latter the length of a ſydereal year. The Earth travels at the rate of 68,243 miles an hour, in its orbit ; which motion is upwards of 140 times ſwifter than a cannon ball. The viciſſitudes of day and night are cauſed by the Earth's rotation round its axis, from weſt to eaſt, which makes the Sun, and other heavenly bodies, ſeemingly move from eaſt to weſt ; and the angle the Earth's axis makes with its orbit, which is 66° $30'$, occaſions the inequality of ſeaſons, days and nights. The Earth is illumined by the Sun, and reflected light of the Moon, and planets,

and

and fixed ſtars. It is an opaque round body, but flattened a little towards the poles, which occaſions a difference of 36 miles between its equatorial diameter and its axis, and, ſcientifically expreſſed, makes the Earth an oblate ſpheroid. By the Earth's violent motion round its axis, there is more matter accumulated about the equatorial parts than any where elſe, which occaſions the flatneſs at the poles, and ſwelling about the equator.

The ſphericity of the Earth in other reſpect is undeniable. Its round ſhadow on the face of the Moon in an eclipſe; the intervention of the convex part of the Sea between the eye and a ſhip's maſt head, and hull, its very rotation round its axis, and its having been ſo often circumnavigated, leaves no manner of room to doubt of its ſpericity. The mountains and vallies on its ſurface being no more in compariſon to its bulk than the duſt on an artificial globe.

The known, and unknown parts of the Earth, together with the Seas, contain 199,512,559 miles; about $\frac{3}{4}$ of which ſuperfices is water.

The Earth is ſurrounded with an atmoſphere of air, that preſſes on all parts of its ſuperfices, and grows thinner in meaſure as it is diſtant from its ſurface. This atmoſphere buoys up the clouds and vapours, and refracting the ſun's rays, prevents a ſudden tranſition from light to darkneſs, by keeping his image in view ſome minutes longer above the horizon

than

than it would be if there were no refraction, and brings it in ſight as much ſooner before it riſes, at about 6 minutes every day at a mean rate.

Our luminary, the Moon, is not conſidered as a planet ; but only a ſatellite attendant on the Earth ; performing her circuit round the earth from change to change in 29 days, 12 hours and 44 minutes ; making 13 revolutions round the earth, wanting 8 hours and $\frac{1}{4}$, whilſt the earth is performing one revolution round the ſun ; the difference between which ſolar year and lunar year is called the Epact. TheMoon's diameter is 2180 miles, and her diſtance from the earth's centre is 240,000 miles. She goes round her orbit in 27 days, 7 hours and 43 minutes, moving at the rate of about 22,290 miles every hour ; and turns round her axis exactly in the time that ſhe goes round the earth, which is the reaſon of her keeping the ſame ſide towards us, and makes her day and night taken together, as long as our lunar month.

The Moon has no atmoſphere, as has been repeatedly made evident by teleſcopical obſervations, conſequently, no ſeas. Thoſe dark ſpots in the moon, once thought to be ſeas, are now found to be only vaſt deep cavities, which reflect not the light ſo ſtrongly as others. To her the Earth ſeems to be the biggeſt body in the univerſe : For it appears thirteen times as big as ſhe does to us.

4th. The planet Mars is next above the earth's orbit.

orbit. His diſtance from the ſun is 145,014,148 miles. His diameter is 5400 miles. He goes round the ſun in 686 of our days and 23 hours. His motion in his orbit is 68,243 miles an hour; and his diurnal rotation 24 hours & 40 minutes. Mars is of a fiery red aſpect, and by his appulſes to the fixed ſtars, ſeems to be encompaſs'd with a very groſs atmoſphere. He appears through a teleſcope ſometimes gibbous, but never horned.

5th. Jupiter, the biggeſt of all the planets, is conſiderably above Mars; being 495,000,000 of miles from the Earth wanting 24 miles. His diameter is 94,000 miles, which makes him near 1200 times as big as the earth, notwithſtanding which amazing magnitude, he turns round his own axis in 9 hours and 56 minutes, and moves in his orbit at the rate of 25,920 miles an hour. His year contains 10,470 days. His body is ſurrounded by faint ſubſtances, called Belts, lying parallel to his equator, which by the changes obſerv'd in them are thought to be clouds. So large a body and ſo diſtant from the Sun, he muſt receive conſiderably leſs heat and light from it than the interior planets: To compenſate which, he is ſupplied with 4 moons or ſatellites, ſome bigger and ſome leſs than our earth, which revolve about him in the times and at the diſtances repreſented in the angles of the plate.

6th. Saturn, the remoteſt of all the planets, is about 908,000,000 of miles from the Sun, and,

travelling at the rate of 22,100 miles an hour, he performs his revolution in 29 years, 167 days,and 5 hours. His diameter is 78,000 miles.

This planet is furrounded by a thin broad luminous ring, as an artificial globe is by a horizon, with 5 moons, which revolve round him with-out. Her ring compenſates for the ſmall quantity of light he receives from the Sun. Their orbits are repreſented in the ſcheme, together with the ring that encompaſſes Saturn.

7th. Next in order is the planet Herſchel,diſcovered the 13th of March, 1781, byMr. Herſchel, a German aſtronomer. This planet is the moſt exterior one that has been as yet diſcovered in the Solar Syſtem, and two ſatellites already has been obſerved to circumvolve him. He is 83 years and almoſt 33 days performing his revolution round the Sun, and is, according to the obſervations taken by Mr. Herſchel's micrometer, 35,511 miles in diameter, and 1805 millions of miles diſtant from the Sun, which conſequently makes the diameter of his orbit,which limits as yet the planetary ſyſtem, 3610 millions of miles in diameter.

BESIDES the Planets, there are Comets in various, and vaſtly eccentric Orbits revolving about the Sun, in different ſituations and periods of time. Beyond the Orbits of theComets, at inconceivable diſtances, are the fixed Stars, which are ſo many Suns diſpenſing light and heat to planetary worlds,revolving round them.

SIRIUS, theGreat Dog, is computed to be 2 billions and 200,000 millions of miles from us. So that Sound would not arrive to us from thence in 50,000 years ; and a cannon-ball would require 700,000 years, at the rate of 480 miles an hour to reach us.

WITH reſpect to the Comets, various were the conjectures concerning them.

THE extreme heat, the denſe atmoſphere, the chaotic ſtate of the Comets, have induced ſome to believe they are ſo many hells for tormenting the damn'd with perpetual viciſſitudes of heat and cold. See Whiſton, &c. Some have had the vanity even to inſinuate, that Comets were the works of the Devil, invented by him to oppoſe the meaſures of the Omnipotent.

OTHERS conceiving Comets to have been created to chaſtiſe this and other worlds, have preſumed that theſe ignited bodies in their approaches to the Sun, in imbibing his heat, abſorb from him amongſt others, his moſt noxious and malign qualities, which in their reſpective returns and revolutions, impregnating the atmoſpheres of the planets and circumambient elements with the earth, as it were, by contagion, partakes of. Hence droughts, famines,plagues, leproſies & the like,and the juices of the human body contaminated, the brain diſturbed, and human paſſions thereby irritated ; rapine—ſuicides—parricides and wars enſue.

SOME giving a greater latitude to conjecture, have from the great eccentricity of the Comets orbits,and the aſtoniſhing lengths they run into empty ſpace, conceived that they pervade other planetary regions and their reſpective Suns,and

girting round them as they do round ours, thus by elliptical links connect ſyſtems & ſyſtems together. Others as vaguely have furniſed, that HE who could create, and ſet in motion, this greatPlanetarium, could cauſe Suns to blaze and Comets to dive from ſuch aſtoniſhing altitudes of ſpace, to the very centre of our ſyſtem, and aſcend again, could with the ſame eaſe, cauſe the orbit of aComet to dilate or contract ſo as to cauſe the Comet in its travels thro' our ſyſtem, to meet in its flight this,or any otherPlanet,and daſh it to atoms. I ſay, vaguely have they furniſed thus, it being as inconſiſtent with the laws of reaſon,to admit of whatis incompatible with the laws of nature, (eſtablithed by the Omnipotent) to happen. Others have thought Comets to be fiery meteors, generated in the air, and other opinions no leſs erroneous have been conceived concerning them : but ſince the great improvements made in aſtronomy, and all its collateral ſciences,chronology, optics, ſtatics,&c. they have been diſcovered to be fixed bodies, or earths, of prodigious denſity, and of different degrees of magnitude, and extenſion, revolving about the Sun in very eccentric ellipſes, and deſcribing equal areas in equal times. 'They 'have long tranſlucid tails iſſuing from that ſide 'which is turned from the Sun, and are of a 'much greater denſity than the earth, for ſome 'of them are heated in every period to ſuch a 'degree, as would vitrify, or diſſipate any ſub-'ſtance knowa to us.'

Monſieur Piogre, an eminent modern author, in his Cometographie, *ou Traite des Cometes* page 117, ſays, that though it is not poſſible to

determine

determine at preſent the number of Comets, there are near 380 Comets of whoſe appearance, at leaſt there is probable teſtimony, but the periods of only three of them being perfectly known, I ſhall not attempt an account of any more, as a deſcription of them will be ſufficient to convey an idea of Comets in general. The firſt of theſe Comets appeared in the years 1531, 1607, 1682, and 1758 ; its period being 75 years.

The next that appeared was in 1532, and 1661 ; its period being 129 years neareſt. 'The interval between the paſſages of this Comet by the perihelion in 1532 and the one of 1661 is 128 years, 89 days, and 29 minues, which added to the time of its perihelion in 1661, allowing for 32 of the years being Biſſextile, together with the 11 days, to reduce to the Gregorian ſtyle, brings out the expected time of the next perihelion, to be April 27th, 1 hour 10 minutes, 1789.'

Doctor Halley, and other Aſtronomers have diſcovered ſuch a ſimiliarity between the elements of the orbits of the Comets of 1532 and 1661, that they have left no room to doubt of their being one, and the ſame Comet, then the interval of time between the coming to the perihelion of the Comet of 1532 and 1661, as already obſerved, being 128 years, 89 days, 1 hour, and 29 minutes ; we may reaſonably expect the Comet in queſtion, to be viſible the latter end of the year 1788 or the beginning of the year 1789, and certainly ſome time before the 27th of April 1789.

It will approach us from the ſouthern part of its orbit and therefore will have conſiderable South latitude and with South declination.

This Comet's motion is direct.

The Perihelion diſtance of this Comet from the Sun is 0, 44, 851 ; that is, in ſuch parts as the mean diſtance of the Sun from the Earth, contains 100,000 parts. Then to find its diſtance in Engliſh miles ſay,—If 100,000 parts require 95,173,000 miles, (which is the diſtance of the Earth from the Sun) how many miles will 0,44,851 parts require ? and you will have the Comet's Perihelion diſtance in Engliſh miles.

The place of its aſcending Node is 2 ſigns, 24 degrees, and 18 minutes, that is, 24° 18′ in Gemini.

The inclination of the Plane of its orbit to the ecliptic is 32° 36.′

Its Perihelion forwarder in its orbit than its aſcending Node, 33° 28′.

Its Perihelion 00° 50′ 00″ in Leo ☊.

The time of its Perihelion calculated for the Meridian of London, is fitted to 10 minutes paſt one o'clock in the afternoon the 27th of April, 1789, then there being 70 degrees difference of Longitude between the Meridian of London and the Meridian of Boſton, and 15 degrees of Longitude being equal to one hour of time and one degree of longitude equal to 4 minutes of time, and 15 minutes of a degree equal to 1 minute of time, in 70 degrees there will be 4 hours and 40 minutes difference of time between London and Boſton, which added to the Periodic time at London, reduces it to the Meridian of Boſton, & makes its Perihelion at Boſton, 27th April, at 50 minutes paſt 5 o'clock in the afternoon.

H.	M.	S.	
1	10	0	
4	40	0	
5	50	0	P.M.

To

To perfectly elucidate which, I have annexed to this work, a Diagram, to which I have fixed Threads, which when extended ſhow thePerihelion diſtance of the Comet—ſhow the angle its orbit makes with the ecliptic, and the diſtance the Earth will be from it at that time – to be meaſured from theScale on theDiagram ; and for a further ſatisfaction to the Readers, as it is known that the Perihelion of Comets alter every period, and their Perihelion diſtance from the Sun likewiſe ; they muſt recollect that the motion the Sun has round the centre of gravity, as has been already obſerved, bringing the centre ſometimes nearer the vertex of the Comet's orbit, and removing it ſometimes farther from it will conſequently alter the Perihelion diſtance, and make it greater or leſs in meaſure as the Sun's centre happens to be removed nigher or farther from the vertex of the Comet's orbit, and the point of the Perihelion altering in the Heaven's ariſes from the preceſſion of the Equinoxes, which is a more or leſs extenſive angle in proportion to the Periodic Times. All which things being premiſed, we will now return to theComet in queſtion,which will certainly be viſible in our hemiſphere on or before the 27thApril 1789, at which time it will be between the orbits of Mercury and Venus, and ſo ſufficiently diſtant from the Sun as not to be merg'd in his rays, before his riſing or after his ſetting, but it muſt not be inferred from this,that theComet's perihelion will happen preciſely at the above mentioned time ; we only may reſt aſſured of the Comet's being viſible on,or before that time,

but

but how much ſooner cannot be perfectly aſcertained. The Comets motions being leſs uniform than the Planets, and by their approaches to the Planets, particularly to the planets Jupiter and Saturn, in their deſcent to their perihelions and aſcent upwards again towards their aphelions, are liable to be accelerated or retarded in their motions, in proportion to their approximation to or elongation from theſe celeſtial bodies.

The next was the Comet that appeared in 1680. The period of this Comet being no leſs than 575 years, cannot return till the year 2225. This Comet at its greateſt diſtance is about 11,200 millions of miles from the Sun, and at its leaſt diſtance within leſs than a third part of the Sun's ſemi-diameter from the Sun's ſurface. In this ſituation in which Sir Iſaac Newton computed its heat to be 200000 times hotter than red hot iron. It flies with the amazing velocity of 880,000 miles an hour, and the Sun as ſeen from it, appears an hundred degrees in breadth, conſequently 40,000 times as big as he appears to us.

It is the opinion of Philoſophers that Comets are capable of doing great injury to the Planets.

The Author of the Hiſtory of the Heavens introduces, amongſt his hypotheſis, the poſſibility of the Earth's having moved uniformly on the plane of the Equator, till the approaches of a Comet, wrenching it out of its original poſition 23° 30′, produced thereby the inequality of days, nights and ſeaſons, we now experience; and at the ſame time, the waters being drawn up by the attraction of the Comet, in its approaches to the Earth, to a conſiderable diſtance without

without its ſurface, in their ſudden fall again, drowned its inhabitants, and diſlocated and diſfigured its ſuperfices ; and thinks it equally probable, that a great body of circumambient vapour remaining aloft, originated an atmoſphere. Hence concludes, that through the means of Comets, a Deluge may be cauſed in one world, and a Conflagration in another.

By the near approaches of a Comet to the Earth, Mr. Whiſton ſuppoſes, the Deluge was occaſioned : and he ſays, the ſame Comet, in 1680, paſſed ſo near the Earth's orbit, that had the Earth then been in that part of its orbit near which the Comet paſſed, a ſecond Deluge, or ſomething worſe, might have happened. He ſuppoſes, however, and it is the general opinion of modern Philoſophers, that Comets may be very ſalutary to the ſyſtem, by being inſtrumental in recruiting the expended fuel of the Sun, and ſupplying the exhauſted moiſture of the planets : and ſome have ſuppoſed that they anſwer a much nobler purpoſe, by being the habitations of rational creatures, capable of admiring the works of the creation—which, from the eccentricity and immenſe extenſion of the Cometary orbits, they are much better ſituated for obſerving, than the inhabitants of any of the planets of our ſyſtem.

I ſhall finiſh this ſhort deſcription of the Solar Syſtem by a quotation from Mr. Whiſton :—

" When we conſider the infinite power and goodneſs of the Deity—the latter inclining, and the former enabling, him to make creatures ſuited to all ſtates & circumſtances ; that matter exiſts only for the ſake of intelligent beings ; and that,

that, wherever we find it, it is pregnant with life, or neceſſarily ſubſervient thereto; the numberleſs ſpecies, the aſtoniſhing diverſity of animals in earth, air, water, and even on other animals; every blade of graſs; every tender leaf; every natural fluid, ſwarming with life; and every one of theſe enjoying ſuch gratifications as the nature and ſtate of each requires: When we reflect, moreover, that, ſome centuries ago, till experience undeceiv'd us, a great part of the Earth was judged uninhabitable—the torrid zone, by reaſon of exceſſive heat, and the two frigid zones, becauſe of their intolerable cold: It ſeems highly probable, that ſuch numerous and large maſſes of durable matter as the Comets are, however unlike they may be to our Earth, are not deſtitute of Beings capable of contemplating with wonder, and acknowledging with gratitude, the wiſdom, ſymmetry and beauty of the Creation; which is more plainly to be obſerved in their extenſive tours through the Heavens, than in our more confined circuit." And he concludes by obſerving, "that however difficult it may be, circumſtanced as we are, to find out their particular deſtination, this is an undoubted truth, that wherever the DEITY exerts his power, he alſo manifeſts his wiſdom and goodneſs."

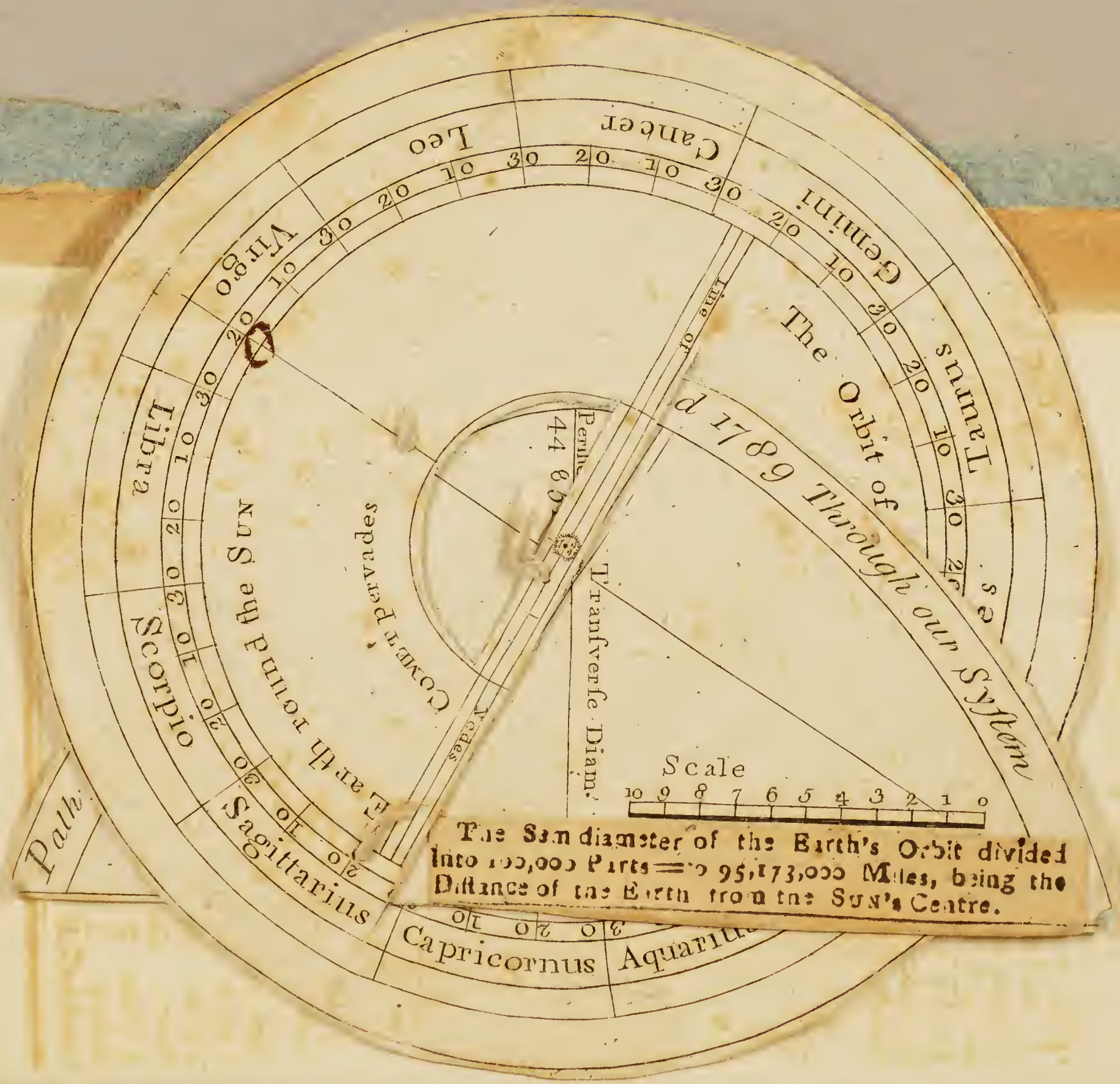
ERRATA.

Page 4, line 29, for "trophical" read tropical.—— p. 5, l. 18, for "ſpericity" read ſphericity.—p. 8. l. 6, after "rizon" inſert, and.——l. 7, for "Her" r. His.

THE Hieroglyphic [♈] that repreſents Aries, (in the copperplate,) that it might not look confuſed, if put in the ſame department of that Conſtellation, is engraved at the back of the word Aries ; and ſo on with the reſt of the Signs throughout the Circle.

N. B. *In the Account given of the Planets, (excepting Herſchel) the Words are partly the learned Ferguſon's blended with ſome of my own. —The Quotations I meant to have mark'd with Commas, but it having eſcap'd my memory, and unwilling any thing that had the complexion of Plagiary ſhould be ſubmitted to the peruſal of the Publick, I reſolved on making this* N. B.

THE AUTHOR.


Cancer
Leo
Gemini
Taurus
Virgo
Libra
Scorpio
Sagittarius
Capricornus
Aquarius
Path
The Orbit of the Earth round the Sun
Comet's Path pervades
Transverse Diam.
Time of
1789 Through our System
Scale
10 9 8 7 6 5 4 3 2 1 0
The Semi diameter of the Earth's Orbit divided into 100,000 Parts = to 95,173,000 Miles, being the Distance of the Earth from the Sun's Centre.

Explanation of the large Plate.

THE exterior Circle repreſents the Ecliptic and Circumference of the Sun, in Diameter 890,000 miles—The Diameter of which Circle being in ſtrict Proportion to the Diameter of Jupiter and the other Planets, it ſhows to what an aſtoniſhing degree the Sun exceeds in Magnitude its circumvolving Orbs.

THE Central Point repreſents the SUN,

The 1ſt, 2d, 3d, 4th, 5th, 6th } Circle repreſents the Orbit or Path of { ☿ Mercury. ♀ Venus. ⊖ Earth. ♂ Mars. ♃ Jupiter. ♄ Saturn.

	The Aphelions of the Planets.			The Angles the Planets Orbits make with the Plane of the Ecliptic.			Aſcending Nodes.		
	o	m	s	o	m	s	o	m	s
Mercury ☿	12	44	00	6	59	20	♉	14	42	00
Venus ♀	4	19	54	3	23	05	♊	14	25	54
Earth ⊖	8	1	10							
Mars ♂	0	31	54	1	52	00	♉	18	29	54
Jupiter ♃	9	9	54	1	20	00	♋	7	19	54
Saturn ♄	27	44	54	2	33	30	♋	21	49	54
Herſchell *H*										

ADVERTISEMENT.

THE Author of the foregoing Pages is now preparing for the Preſs, an entire new Work, to be entitled,

The American Seaman's

Daily Aſſiſtant.

Which, when compleated, will be ſubmitted to the Examination of Men of known Abilities, for their Approbation—and if approved of as a Work of publick Utility, the Patronage of the Publick will be ſolicited.

James G. Wynne
28154
June, 1938

DT39
.B54s